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Anthracnose disease of bean: Early identification and management

Bean anthracnose, caused by *Colletotrichum lindemuthianum*, is a major fungal disease affecting all types of beans. Significant yield loss can occur with susceptible cultivars when contaminated seeds are used, especially under environmental conditions that favor disease development.

Symptoms

In susceptible cultivars, anthracnose symptoms can appear on any plant part, starting with seed germination.

Seedling

Initial symptoms may appear on cotyledonary leaves as small, dark brown to black lesions. Symptoms on hypocotyl-infected tissues manifest as minute rust-colored specks. These specks gradually enlarge longitudinally and form sunken lesions.

Leaf

In the leaves, lesions first appear on the lower surface. Leaf veins turn brick red to purple and eventually dark brown to black. This is one of the most important identifying characteristics of bean anthracnose disease on foliage (Figure 1) before pods get infected. Later, lesions also appear on veinlets on the upper surface of leaves, which can turn black over time.

Pod and seed

Fungal growth on leaf lesions usually produces conidia under favorable conditions, specifically warm and humid weather. These spores can be splashed on the pods, causing pod infections that appear as small reddish-brown lesions. These lesions can quickly enlarge to form typical sunken anthracnose lesions. Pink spore mass oozes out from the

Figure 1. Bean anthracnose on leaf. (Photo credit: Manitoba www.gov.mb.ca/agriculture/crops/plant-diseases/anthracnose-dry-beans.html)

Figure 2. Bean anthracnose on pods. (Photo credit: Elizabeth Bush, Virginia Polytechnic Institute and State University, Bugwood.org)

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Disease of bean – *continued from page 1*

lesions under moist, warm conditions (Figure 2). Diseased pods can lead to infected seeds, which may display yellow to brown lesions on their surface.

Disease cycle

The fungus primarily survives in seeds from one season to another. Infected plant debris can also support fungal survival, although the duration can vary widely depending on the soil and environmental conditions. Initial infection from seeds may show up on the cotyledons and hypocotyl immediately after seed germination. Spores on infected plant debris in the spring also may splash rain on plants and cause infection, if conditions are favorable, such as temperatures between 55 F and 79 F (13 to 26 C) and high humidity at the initial stages of plant growth. Secondary spread of the pathogen can occur through the conidia produced on lesions from primary infections, which often leads to pod infections.

Management

Early detection of the disease on foliage can help management measures to minimize the pathogen's spread and prevent pod infections. However, integrated management measures should start with purchasing disease-free seeds.

Seeds that were grown in an arid or semi-arid environment will likely have fewer anthracnose infections. Buy from a reputable company or choose certified seeds.

Rotate fields with a crop from a different family, such as Gramineae or Cruciferae for at least two years.

Remove plant debris at the end of the season or deep plow to bury the debris in the soil. Anthracnose pathogen does not survive too long without plant debris.

Use resistant varieties against the prevalent species of fungus.

Use drip irrigation instead of sprinklers to keep leaf wetness to a minimum.

Chemical control

Fungicides can be used in conjunction with other non-chemical methods if other methods do not adequately keep the disease under control. Some of the best performing fungicides against anthracnose are strobilurins, fluazinam and thiophanate-methyl.

Squash vine borers

Squash vine borers attack several crops of the cucurbit family, but banana squash, winter squash, buttercup, zucchini and pumpkins are the most susceptible. Squash vine borers are diurnal fliers that belong to the order Lepidoptera. One larva of squash vine borer can kill the entire plant if the insect is feeding in the main stem.

Life cycle

Squash vine borers have one generation per year. In West Virginia, adults emerge from the ground from mid-June to early July. Adults are medium-sized moths, with 2.5- to 4-centimeter wingspans and have a black or dark blue-green thorax with bright orange coloration on the legs and abdomen. The forewings are dark and opaque, while the hind wings are clear.

Adults mate after emergence and then females lay their eggs later. Females can lay anywhere from 150 to 200 eggs in their lifetime, placing them on any part of the plant or in the soil next to the base. The eggs hatch about 1 week after being laid, and larvae bore into the plant. They are small, wrinkled and whitish with a distinct brown head capsule and grow up to 2.5 centimeters in length.

Depending on the weather, the larvae feed on the plant for about 3 to 4 weeks. After that, they burrow several centimeters into the soil that surrounds their host plant and spin a silken cocoon to pupate.

Plant damage and scouting

Larvae are the only stage of this insect species that damage plants. When they burrow into the stems, they disrupt the flow of xylem and phloem, causing their host to wilt as water and nutrients are cut off from the rest of the plant. Larvae also can bore into the fruit. Wilting of vines or of the entire plant is the clearest and most recognizable sign of squash vine borer infestation; however, wilting can be caused by other factors. Adults can be easily noticed because of their size, distinct coloration and loud buzzing noise when they fly. Growers can place yellow traps to detect the time of emergence to make pest management decisions.

Biological control

Although squash vine borers have several natural enemies, they are not commercially available for augmentative biocontrol.

Cultural control

Research has shown that trap cropping is effective against squash vine borers. Using Blue Hubbard squash on the

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Squash – *continued from page 2*

perimeter around summer squash results in the reduction of 88% in squash vine borer infestations in the main crop. Blue Hubbard squash should be planted about two weeks before the main cash crop and should take up 10% of the total cropping area. Crop rotation is effective against this pest because they only attack cucurbit plants. However, crop rotation might be challenging because squash vine borers can flight up to one mile.

Mechanical control

Row covers have shown good control against squash vine borers. However, this practice is not recommended because the activity of squash vine borer adults and blooming happens at the same time. Growers must remove row covers to allow pollinators to do their work. As an alternative, growers can plant later in the season; however, it is not feasible with all crop varieties. Physically killing larvae and eggs is possible in small production, but it is time-consuming and difficult.

Chemical control

Chemical control using insecticides is the primary method used to control squash vine borers. There are several active ingredients that are labeled for this purpose; however, the most effective are pyrethroids and Spinosad. There are several formulations for Spinosad, and some are approved by the Organic Materials Review Institute (OMRI).

Figure 3. Close-up of squash vine borer on leaf. (Photo credit: C. Quesada)

Cider apple cultivar fire blight susceptibility rating

We established a cider apple orchard at one of the West Virginia University farms in Morgantown with two major goals: to create a teaching tool enabling students to get hands-on, experiential learning opportunities in orchard management, and give us a field lab for cultivar evaluation.

The evaluation aims to gain information necessary for supporting the developing hard cider industry in the state. Part of the evaluation process was determining their relative disease susceptibility, with major emphasis on fire blight, a disease caused by bacterium *Erwinia amylovra*, capable of infecting blossoms, shoots, woody tissue and rootstocks. Besides apples, it will infect more than 75 species in the rose family (*Rosaceae*). This disease is common throughout the United States and the world.

In early May 2023, the weather conditions created a perfect environment for disease to strike. Late-blooming cultivars had open blossoms; temperatures were high with rain added to the mix, resulting in high infection. On the positive side, it was an opportunity to observe and evaluate how various apple cultivars respond to fire blight under the given weather conditions. The evaluation results are presented in the chart below.

Apple Cultivar	Fire Blight Susceptibility Rating
Antonovka	S
Arkansas Black	MR
Baldwin	MS
Ben Davis	S
Blue Pearmain	MS
Brown Snout	VS
Brumley's Seedling	MR
Burkittsville Red	MR
Calville Blank	MS
Chestnut Crabapple	R
Dabinett	VS

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Apple – *continued from page 3*

Apple Cultivar	Fire Blight Susceptibility Rating
Dolgo Crabapple	R
Duchess of Oldenberg	S
Ellis Bitter	S
Golden Russet	R
GoldRush	R
Grimes Golden	MR
Harrison	MR
Harry Masters Jersey	MR
Heredforshire Redstreak	MR
Hidden Rose	R
Karmerrien	MS
King David	MS
Medaille d'Or	VS
Nova Spay	MR-R
Porter's Perfection	MR
Redfield	R
Roxbury Russet	MR
Spitzenburg Esopus	VS
Stoke Red	R
Sweet Coppin	R
Tremletts Bitter	R
Virginia Crabapple	MR
Yarlington Mills	VS
Wickson Crabapple	VS
Williams Pride	R
Winecrisp	MR
Wolf River	MS-S

VS = Very Susceptible; S = Susceptible;
MS = Moderately Susceptible; R = Resistant;
MR = Moderately Resistant

Figure 4. Fire blight in cider apple trees. (Photo credit: M. Danilovich)

Figure 5. Close-up of fire blight bacterial movement from flowers to the leaves. (Photo credit: M. Danilovich)

Managing herbicide injury in vegetables

Vegetables are highly sensitive to herbicides, and even small amounts can cause serious damage. Herbicides may come into contact with vegetables through spray drift, vapor movement (volatility), water or soil runoff, or through contaminated compost, manure, or mulch made from treated materials.

Spray drift occurs when airborne herbicide particles move from the application area, especially under windy conditions. Volatility happens with certain herbicide formulations that can vaporize and travel long distances,

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Herbicide – *continued from page 4*

particularly when applied in hot weather, resulting in widespread, non-localized injury. Runoff involves the movement of water or soil carrying herbicide residues from treated areas, often following heavy rainfall.

However, one of the most common causes of herbicide injury in home vegetable gardens is the use of contaminated mulches, compost or manure.

How gardening materials can become contaminated

Grass clippings from lawns treated with herbicides – often those in Weed & Feed products – can remain active in the soil for weeks to months. If these clippings are used as mulch around vegetables during the same season, sensitive plants can develop herbicide injury and become unsafe to eat. In some cases, residues in mulch or compost can persist into the next growing season and harm new plantings.

Similarly, certain herbicides applied in pastures or hayfields can remain in harvested hay and the manure of animals fed with this forage. These herbicides typically carry specific label warnings advising against the use of treated materials in gardens or compost piles, but those guidelines are not always followed.

Recognizing herbicide injury symptoms

Most herbicide injuries in gardens are caused by growth regulator herbicides, which mimic natural plant hormones called auxins and disrupt normal growth.

Symptoms of exposure often include:

- Cupping, twisting and curling of leaves and stems
- Strap-shaped or misshapen leaves
- Overall distorted plant growth

These symptoms are collectively referred to as epinasty. While vegetables like tomatoes, beans and peppers are especially sensitive, trees and shrubs, such as ash, pine and spruce, can also be affected by herbicide drift or root absorption through contaminated runoff.

Herbicide persistence and how to test for it

Some herbicides can persist in hay, grass clippings and manure for months – even surviving the composting process. Studies suggest that composting for extended periods, more than 200 days, may reduce herbicide levels by more than 50%. However, it is safest to avoid using any materials suspected of contamination in vegetable or ornamental plantings.

Sensitive plant families include:

- Legumes (peas, beans, clover)
- Composites (sunflower, lettuce)
- Nightshades (tomato, potato, pepper, eggplant)

To check for herbicide residues, gardeners can perform a simple bioassay. They should plant sensitive species, such as beans or tomatoes, in soil filled with the suspect material, alongside a control container with clean soil. If characteristic injury symptoms develop in the test container, it is likely herbicide residue is present.

Other common causes of plant injury

Systemic herbicides, such as glyphosate (commonly sold as Roundup), also can harm nearby desirable plants through drift or accidental contact. Even small amounts can kill sensitive plants, though symptoms may take 2 to 3 weeks to appear.

Good practices include:

- Leaving adequate buffer zones between treated and desirable plants
- Keeping detailed records of herbicide applications
- Asking farm suppliers about the source of any manure, hay or bedding
- Conducting a bioassay if there's uncertainty
- Using a dedicated sprayer for herbicides to prevent cross-contamination with other garden treatments

Ultimately, following label instructions carefully and maintaining clear communication between applicators and gardeners is essential for protecting plants and avoiding costly damage.

About IPM Chronicle

Rakesh S. Chandran,
IPM Chronicle Manager
304-293-2603

WVU Extension Contributing Authors:

Rakesh S. Chandran,
Weed Scientist and IPM Program Coordinator

Mira Danilovich,
Consumer Horticulturist

Carlos Quesada,
Entomologist

MM (Mahfuz) Rahman,
Plant Pathologist